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Dixwell, the new series of the Academy's Transactions be presented to Dartmouth College.

Four hundred and seventeenth meeting.

September 11, 1855. — ADJOURNED QUARTERLY MEETING.

The PRESIDENT in the chair.

Professor Joseph Henry, of the Smithsonian Institution, addressed the Academy on the subject of the induction of electrical currents at great distances from the primitive current, and on the oscillating movements which he had detected in these currents, giving a positive or negative character at any given point at different times. He also gave an account of the numerous experiments he had made to establish the facts which he had announced.

Dr. A. A. Hayes remarked, that

"The facts communicated by Professor Henry are of high interest and importance, in their bearing on any theory of electrical action. The phenomena presented in the observations of Professor Henry correspond, in a remarkable manner, with those taking place when a hydro-electric current acts on a conductor of the first class. In the case of a continuous polarization, the central parts of such a conductor exhibit no power of decomposition, even when the current is feeble. A simple experiment, which illustrates this condition of a polarized conductor, may be made by immersing a curved wire in a solution of metallic salt, the metal of which can be displaced by the metal of the curved wire. If a wire of soft bright iron, bent in the form of a horseshoe magnet, have its bend barely dipped into an acidulated solution of sulphate of copper, the copper will be deposited on it as it would be on a straight wire. But if the curved wire be lowered into the solution, or if at first it be at once immersed, the deposition of copper by displacement occurs at the free extremities of the wire and extends towards the bend from them. It ceases, however, before it reaches the bend, or central part, which never receives more than the slight coating due to the instant exposure in immersing it. This experiment may be varied by modified curves of the wire; but however numerous the forms of the bends, the central part of each wire or plate is null in its action as an electrode."

Dr. A. A. Hayes read the following communication on a specimen of native iron from Liberia, Africa: —

"It is with pleasure that I submit to the inspection of the Academy a specimen of native iron from Liberia, believed to have been taken from the tract of country bordering the St. John's River, recently acquired by the New Jersey colony. This specimen was placed in my hands by Rev. Joseph Tracy, Secretary of the Massachusetts Colonization Society, for examination, and its physical characters at once arrested my attention, as differing from those of any artificially produced iron. As I deem the discovery of native iron existing unalloyed a matter of much interest to naturalists and chemists, it is proper that the evidence on which the statement rests should be submitted somewhat in detail. In the African Repository, Vol. XXX. No. 8, August, 1854, at page 240, is a letter from Rev. Aaron P. Davis, a resident missionary at Bassa Cove, from which the following extracts are taken. 'I send you a piece of African *ore*, just as dug from its native bed, or broken from among rocks. I have seen and conversed with a number of natives, who affirm that it is actually the pure ore, or just as taken from its native bed. I obtained a piece through Hon. George L. Seymour, who had tried in vain to dissect it: and I being of that craft, he brought it to my shop for that purpose. When he brought it, it appeared like a craggy rock, of yellowish color on its surface, and, with a very small exception, it could not be separated but by heat and hard pounding with my largest sledge-hammer and a chisel prepared for the purpose. I also send you a teaspoon which I made of some of the ore, which in its crude state is superior to the iron brought here for sale by English merchant-vessels.' 'I am told by the natives that it is plentiful, and about three days' walk from our present place of residence (Bassa Cove): it is gotten by digging and breaking rocks. It is also said to be in large lumps. In these parts the natives buy no iron, but dig it out of the ground, or break the rocks and get it, as the case may be.'

"The largest specimen before you, when received by me, bore on one side the impress of the chisel, the coarse fracturing of a tough metal, and marks of oxidation by fire; it was further identified by William Coppinger, Esq., of Philadelphia, as the piece received with the letter of Mr. Davis. Mr. Coppinger gave the specimen to Rev. H. M. Blodgett, who sent it to Rev. Joseph Tracy, from whose hands I received it. Soon after I had expressed to Mr. Tracy my belief that the specimen was native iron, he placed before me a large amount of written evidence, showing that malleable iron, sufficient in quantity to meet the wants of the natives, is obtained by heating and then by fracturing the rocks of the country. The writers use the term *ore* incorrectly, as Mr. Davis does, apparently in the belief that iron ores increasing in richness become malleable. The metallurgical knowledge of the natives is so limited, that they are unable to produce copper from the carbonate of copper (malachite), which they carry five or six hundred miles as a medium of traffic; while their weapons of iron, which I have examined, show the characters of native iron, after it has been heated and hammered.

" *Physical Characters.* — On developing the internal structure of the mass of iron, by immersion for a few moments in strong nitric acid, and immediately after washing in a mixture of lime and water, it was apparent that the minute crystalline particles were arranged in a manner closely resembling those of the pure iron * in meteoric iron, and entirely unlike the particles in artificial iron.

" Where the mass had been heated, and had received blows, there was an approach to the appearance presented by artificial iron, but the internal parts, and nearly the whole of the mass, showed no marks of percussive or laminating action. By the more complete development of the structure, certain points appeared which were evidently extraneous matter. Under the microscope these points showed crystalline minerals, which when separated proved to be quartz and octohedral oxide of iron. A mineral with a lime and soda base was also found. The iron was most readily acted on by chemical agents, where it was in contact with these minerals; exposure of a surface to the action of an acid not only brought them to view, but produced cavities at the points where they existed; showing degrees of porosity influenced by their number.

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* " The character which is here noted has a higher value in a research of this kind, than would have been inferred from a cursory examination. In a description of the remarkable meteoric iron, published in the American Journal of Science, November, 1844, I alluded to the fact, that these masses are not made up of iron alloyed with nickel and other metals, but consist of *pure iron,* through which are mixed portions of an alloy of nickel and iron, and iron and nickel and other bodies, as distinct *electro-negative* matter, in relation to the pure iron. The Texas meteoric mass and the small particles of the Western meteorolite had the same mechanical constitution. Since the first publication of my results, these researches have been extended, so as to include the metals of commerce and the well-known alloys. The numerous analyses made on these forms of matter have not yet shown an exception to the condition, that the metal existing in the largest proportion is in part pure; while one, two, three, or more alloys may exist, distributed through it. When we take the results on a mass of crude iron in the state of pig-iron, and on portions of the less and more malleable iron, of the different steps of the manufacture, we not only pursue the constituents chemically, but the mechanical state of the iron is at the same time open to view. A mass of pig-iron thus becomes associated with meteoric iron, in the mechanical arrangement

"The sp. gr. of the most compact portion was 6.708. Its color was lighter gray than any sample of artificial ductile iron I have seen. Repeated bending back upon itself did not separate one fragment, but generally flaws appear and thin portions break when doubled close. The presence of the minerals imbedded is felt, when we file or saw the metal; but when heated and hammered, these fuse into slags, and the metal spreads and draws off, like the best irons, yet showing the cavities and flaws where the simple minerals had existed.

"*Chemical Characters.* — It dissolves with effervescence in diluted hydrochloric acid, and if the acid and water are perfectly pure, the evolved gas has no odor. 200 grains were dissolved in hydrochloric acid, the hydrogen gas was passed through pure alcohol kept cool, and was then allowed to bubble through an ammoniacal solution of nitrate of silver. The alcohol had not acquired odor, nor was there any coloration or change in the silver solution. The solution of iron was turbid, but soon deposited suspended matter, which was light-gray colored; some heavy white sandy grains, and some dark, nearly black particles, had fallen. After collecting and drying these substances,

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of its parts, and generally consists of perfectly pure and malleable iron, disturbed in the arrangement of its crystalline particles by the interposition among them of a compound of iron and carbon and of graphitic carbon, besides sulphides, phosphides, and arsenides of the alkaline metals. In the ductile iron, these bodies have been nearly all removed by heat and mechanical operations, and new features impressed upon the metal. By simply removing the interposed foreign matter, by chemical means solely, crude iron is left malleable, and its particles then show their sub-crystalline forms, but not as they exist in the pure iron of the more perfect meteoric masses. All manufactured iron presents them arranged in lines and interlaced by the action of the hammer, or extended in bundles in the act of drawing; while the laminating mill breaks them down, shingling them over and felting together their serrated edges, in striking analogy of effect to the operations of textile manufacturing. The mechanical texture of a mass of iron cannot be shown fully by the simple step of immersion as above given, but this is sufficient to enable one to observe whether the crystals have arranged themselves as aggregates, or been broken up and disturbed by violence, and often will serve to show the kind of mechanical action employed."

they were placed under the microscope, which showed the heavier bodies to be quartz, with some facets and fragments of octohedral crystals, proved to be magnetic iron-ore. The light body was silicic acid, rendered gray by iron oxide.

" Chlorine was passed into the filtered iron solution, which, after being heated and cooled, was precipitated in a partly closed flask, by gaseous ammonia passed into it in excess. After being heated by a vapor-bath, the precipitate was separated by filter and washed.

" The filtrate and washings evaporated were reduced to a dry mass, which afforded a minute quantity of soda and lime: no other substance was present.

" Separate parcels of the precipitate by ammonia were used for the detection of Phosphorus, Arsenic and Boron, Alumina, and other earths and oxides: a little silicic acid only was found.

" 50 grains of the filings of the iron were wet with a few drops of perfectly caustic soda solution, mixed hastily with crystals of pure nitrate of soda and chlorate of potash, and heated in a nearly closed platina crucible rapidly to bright redness twenty minutes: no deflagration occurred and the fused salts were colorless.

" The crucible, after cooling, digested in a closed vessel with recently boiled pure water, gave its soluble part to the water. After subsidence, the clear fluid was added to a dilute saturated solution of lime in ammonia in one vessel, and to a dilute solution of baryta in another. These vessels were closed, and left twelve hours, and then presented nearly transparent solutions; no precipitates had fallen, but both showed the presence of silicic acid. The absence of sulphur and carbon was thus proved, and other trials confirmed these results.

" *Analysis.* — In the following analysis, and in repetitions, different slabs of the metal were used, so as to obtain an average percentage composition of the mass.

" A solution in pure water of about one hundred and fifty grains of pure sulphate of copper was used as a medium in which the iron dissolved replaced by electrolysis the copper deposited on the negative electrode of platinum connected with a small constant battery.

" 26.30 grs. of iron solved in the fluid and 29.78 grs. of copper were deposited on the platinum, while 0.32 gr. of matter was precipitated.

" The equivalent of pure iron being 28, the deposit of copper should have weighed 29.71; an accordance as near as the experiments allow.

“ 0.32 gr. of matter consisted of angular portions of quartz, fragments of crystals of magnetic iron-ore, and a flock of silica: no trace of carbon was observed under the microscope.

“ 26.60 grs. was the total loss from the iron.

“ The partly ferruginous solution decomposed by an excess of hydro-sulphuric acid, evaporated and calcined, afforded barely traces of lime and soda, which in every case have been found to result from the solution of this iron.

“ 100 parts of a sample of this iron, therefore, consist of

Pure iron, ...	98.87
Quartz, iron ore, and silicate, . .	1.13
	100.00

“ Another sample, more nearly an average, from the centre of the mass, afforded in 100 parts,

Pure iron, ...	98.40
Quartz crystals, magnetic iron ore, and silicate of soda and lime, . . .	1.60
	100.00

“ The little slabs which had been the positive electrodes had not disengaged a bubble of gas, which always occurs when the metals affording alkaline bases are alloyed. They also exhibited in their substance the cavities which had contained the mineral bodies found.

“ I was desirous of making some comparative experiments on a specimen of iron having the characters of native iron, as distinguished from meteoric iron. My friend, Professor B. Silliman, Jr., kindly supplied me with two slips from the specimen well known as having been found at Canaan, Conn. He expressed to me at the time a doubt respecting the certainty of this mass being native iron.

“ On subjecting this specimen to analytical trials, it was soon determined that it is an alloy, consisting of iron, iron and carbon, and pure graphite.

“ 100 parts afforded

Pure iron, ...	93.057
Carbon, ...	2.666
Iron from carbon, ...	1.361
Graphite, ...	2.916
	100.000

"In the arrangement of the alloy of carbon and iron, and the lamina of graphite, it differed in no respect from 'Kishy' iron which has been allowed to repose in a heated state, and is unquestionably an artificial iron, — a product of the blast furnace."

Professor Agassiz said that he had received, through the kindness of Dr. Green, of Commodore Perry's Japan Expedition, the bag containing the immature young of a viviparous fish from Japan. He regretted that the whole of the parent fish had not been preserved, but he hoped to be able from the embryos to make out the characters of a new genus, which may be regarded as the Asiatic representative of this interesting type. The specimens were from the shores of Simoda.

Professor J. P. Cooke gave in detail the processes by which he had obtained perfect octohedral crystals of arsenic. He was led to do so by the fact that their genuine character had been called in question.

Dr. A. A. Hayes confirmed, from his own knowledge, the fact of the production of such crystals in other ways.

Four hundred and eighteenth meeting.

October 9, 1855. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Recording Secretary, in behalf of the author, presented the following paper, viz.: "Descriptions of New Species of Fossils, from the Cretaceous Formations of Nebraska, with Observations upon *Baculites ovatus* and *B. compressus*, and the Progressive Development of the Septa in Baculites, Ammonites, and Scaphites. By Professor James Hall, of Albany, N. Y."

Professor J. P. Cooke exhibited and explained a printed chart of his classification of the chemical elements. The plan was the same as one already published by him, with some modifications.